ABSTRACT

SUMOHARJO. Nitrogen Waste Removal in Aquaponic Systems for Tilapia Oreochromis niloticus Production: Configuration of Bioreactors Design. Under direction of KUKUH NIRMALA and MUNTI YUHANA.

The importance of recirculating aquaculture systems is due to their advantages including reduced land and water requirements, and environmental control allowing fish growth at optimum rates. Biofilters are important component in recirculating process and optimization of bioreactor is crucial for fish production system. The aims of the experiment were to compare a hypothetical system design of hydroponic bioreactors in transforming and recycling nitrogen waste resulted from metabolic activity of fish biomass. As the first step in the system evaluation, bioreactors were set up into four modules, namely: (1) rafting technique with solid trap (RTST); (2) rafting technique without solid trap (RTM); (3) nutrient film technique with solid trap (NFTST); and nutrient film technique without solid trap (NFTM) as a control system. Blocked-completely randomized design was used in this experiment. The nitrogen waste removal was analyzed based on the mass balance approach. The differences design in the configuration of each bioreactors resulted in the change of their hydrodynamic characteristics and systematically affected nitrogen removal rate which was indicated by values of nitrification kinetics constant were 1.1 – 1.8 d⁻¹, retained by microbial floc were 10.69-13.25 % of excreted nitrogen, and phototrophically assimilated by green mustard Brassica juncea were 0.19-1.00 % of excreted nitrogen. Fish biomass alone contained 26.97-39.67 % of feed nitrogen. RTST showed the best treatment which ammonia concentration was reduced to 82.4 % and had capacity to remove 0.724 g N·TAN d⁻¹. It could increase maximum carrying capacity of aquaculture system up to 52.7 kg m⁻³ of fish biomass.

Key words: aquaponic, bioreactor, nitrogen removal, carrying capacity